

AEROLOGICAL OBSERVATIONS

By L. T. SAMUELS

Free-air temperatures for January were above normal at the two southern stations, Broken Arrow and Groesbeck and also at Royal Center. (See Table 1.) In general the departures increased with altitude, the maximum being $+3.6^{\circ}\text{C}$. at 3,000 meters at Groesbeck. Smaller departures obtained at Due West and Ellendale than at the other stations but they were mostly negative.

Humidity and vapor pressure departures were small, the principal feature being the positive values of the former at Royal Center where the temperatures also averaged appreciably above normal. The apparent excess of moisture in the free air above this station did not result in any excess in precipitation for the month, however.

The resultant free-air wind movement as shown by kite observations did not depart greatly from the normal, except in the lower levels at some of the stations. (See Table 2.)

The resultant winds above 500 meters as indicated by some 30 pilot balloon stations showed a pronounced westerly component over all of the United States except along the Pacific coast and the extreme southern part of Florida. With the exception of San Francisco the Pacific coast region showed a pronounced southerly component whereas at the former station an equally pronounced northerly component prevailed. At 2,000 meters the resultant winds were southwesterly over all of the Pacific coast region as compared to northwesterly over the rest of the country. At Key West, however, an easterly component persisted to 2,000 meters but became westerly above this height, while at San Juan the westerly component did not obtain until 4,000 meters.

Exceptionally strong winds were observed simultaneously at Cheyenne and Denver on the 3d. A maximum velocity of 76 meters per second occurred at 5,400 meters above ground at Cheyenne and 71 meters per second at 2,400 meters above Denver. The direction in both cases was west-northwest. These high winds occurred on the rear side of an extensive depression centered over Manitoba.

The influence of these large disturbances as regards strong winds extends to greater distances at the higher levels than nearer the surface. For example, on the 5th with a storm centered over Maine the following high velocities were observed at points far to the west and south: Davenport, NW. 42 meters per second, 4,000 meters; Atlanta, NW. 54 meters per second, 3,000 meters; Due West, NW. 54 meters per second, 3,700 meters; Jacksonville, NW. 44 meters per second, 3,600 meters. Only light to moderate winds prevailed at the surface at these stations.

An unusual turning of the wind with altitude occurred at Burlington on the 9th and 10th. Situated in the center of an anticyclone on the 9th there was observed a northerly wind with velocity increasing from 1 meter per second at the ground to 11 meters per second at 1,500 meters, above which a veering to easterly occurred accompanied by a drop in velocity to 4 meters per second. This abnormal direction and velocity continued to at least 4,200 meters where the observation ended. Easterly winds at these elevations in the winter season especially in the higher latitudes usually indicate stagnant conditions or a disintegration of the pressure areas. In this case the latter occurred and on the next day northerly winds near the surface veered to southeasterly at 1,000 meters and continued so to at least 4,400 meters where

the observation ended. The velocity remained unchanged throughout this stratum.

It is sometimes found at the northern stations that a rise in temperature accompanies the passage of the wind-shift line in a depression when the direction changes from southerly to northerly. A pronounced instance of such a change occurred at Ellendale on the 1st. The wind-shift line passed over at 9.30 a. m., accompanied by a rise in surface temperature from -4.3°C . to 6.5°C . and a drop of 54 per cent in relative humidity within 10 minutes. The surface wind veered from south-southwest to west-northwest. One and one-half hours preceding this shift the southerly current was 300 meters thick and was surmounted by a northwest wind. Further evidence of the relatively high temperature of this northwesterly air was found in the pronounced inversion wherein the temperature rose from -8.6°C . at the ground to 12.9°C . at 340 meters. This marked temperature gradient in the lower levels resulted in a pronounced mirage being observed toward the northeast through east to south.

TABLE 1.—Free-air temperatures, relative humidities, and vapor pressures during January, 1927¹

Altitude (m.) m. s. l.	TEMPERATURE ($^{\circ}\text{C}$)									
	Broken Arrow, Okla. (233 m.)		Due West, S. C. (217 m.)		Ellendale, N. Dak. (444 m.)		Groesbeck, Tex. (141 m.)		Royal Center, Ind. (225 m.)	
	Mean	Departure from 9-yr. mean	Mean	Departure from 6-yr. mean	Mean	Departure from 10-yr. mean	Mean	Departure from 9-yr. mean	Mean	Departure from 9-yr. mean
Surface.....	3.3	-0.1	5.1	-0.9	-10.8	0.0	9.2	+1.4	-3.1	+0.8
250.....	3.2	-0.2	5.0	-0.9	-----	-----	9.2	+1.6	-3.3	+0.8
500.....	3.2	+0.2	4.5	-0.8	-10.7	0.0	9.8	+2.5	-4.2	+0.8
750.....	3.2	+0.4	4.4	-0.4	-9.6	+0.4	9.7	+2.5	-3.8	+1.3
1,000.....	4.4	+1.5	4.0	-0.2	-8.3	+0.2	9.8	+2.5	-3.2	+1.8
1,250.....	4.8	+1.9	3.2	-0.3	-7.9	-0.3	9.6	+2.6	-2.9	+2.2
1,500.....	4.8	+2.2	2.1	-0.6	-8.0	-0.4	9.2	+2.7	-3.6	+1.9
2,000.....	3.4	+2.2	-0.1	-1.0	-9.6	-0.5	7.4	+2.5	-5.1	+1.4
2,500.....	1.5	+2.6	-1.9	-0.9	-11.7	-0.4	5.9	+3.1	-6.9	+1.6
3,000.....	-1.2	+2.4	-4.2	-0.9	-13.9	0.0	4.1	+3.6	-8.7	+2.1
3,500.....	-4.3	+1.9	-5.4	+0.1	-16.8	-0.1	-----	-----	-10.9	+2.5
4,000.....	-7.9	+1.2	-8.2	+0.7	-20.3	-0.9	-----	-----	-12.2	+2.5
4,500.....	-----	-----	-----	-----	-----	-----	-----	-----	-14.6	+2.5

Altitude (m.) m. s. l.	RELATIVE HUMIDITY (%)									
	Broken Arrow, Okla. (233 m.)		Due West, S. C. (217 m.)		Ellendale, N. Dak. (444 m.)		Groesbeck, Tex. (141 m.)		Royal Center, Ind. (225 m.)	
	Mean	Departure from 9-yr. mean	Mean	Departure from 6-yr. mean	Mean	Departure from 10-yr. mean	Mean	Departure from 9-yr. mean	Mean	Departure from 9-yr. mean
Surface.....	68	-3	61	-7	79	-3	81	+3	81	+2
250.....	68	-3	60	-7	-----	-----	78	+2	81	+2
500.....	60	-5	57	-5	77	-4	70	-2	80	+6
750.....	55	-5	54	-5	68	-6	66	-2	74	+5
1,000.....	49	-6	55	-2	60	-7	59	-3	67	+3
1,250.....	43	-8	57	+2	56	-6	52	-5	60	+1
1,500.....	39	-8	56	+3	55	-5	47	-6	59	+3
2,000.....	35	-7	51	+3	54	-5	44	-3	61	+9
2,500.....	34	-7	39	-3	55	-4	45	+1	58	+6
3,000.....	36	-5	35	-4	52	-7	42	+2	61	+7
3,500.....	38	-4	20	-16	48	-9	-----	-----	58	+1
4,000.....	40	-4	16	-23	48	-8	-----	-----	57	+1
4,500.....	-----	-----	-----	-----	-----	-----	-----	-----	55	+1

Altitude (m.) m. s. l.	VAPOR PRESSURE (mb.)									
	Broken Arrow, Okla. (233 m.)		Due West, S. C. (217 m.)		Ellendale, N. Dak. (444 m.)		Groesbeck, Tex. (141 m.)		Royal Center, Ind. (225 m.)	
	Mean	Departure from 9-yr. mean	Mean	Departure from 6-yr. mean	Mean	Departure from 10-yr. mean	Mean	Departure from 9-yr. mean	Mean	Departure from 9-yr. mean
Surface.....	5.48	-0.37	6.08	-0.67	2.55	+0.10	9.89	+1.07	4.07	+0.17
250.....	5.43	-0.38	6.02	-0.64	-----	-----	9.45	+0.97	4.03	+0.21
500.....	4.78	-0.41	5.65	-0.40	2.46	+0.05	8.64	+0.81	3.73	+0.36
750.....	4.24	-0.46	5.47	-0.21	2.23	-0.03	7.91	+0.64	3.52	+0.43
1,000.....	3.98	-0.26	5.42	+0.09	2.11	-0.10	6.90	+0.30	3.29	+0.44
1,250.....	3.56	-0.25	5.10	+0.25	1.99	-0.15	5.94	+0.01	2.91	+0.31
1,500.....	3.21	-0.18	4.56	+0.28	1.84	-0.18	5.16	-0.14	2.74	+0.37
2,000.....	2.60	-0.16	3.34	-0.07	1.51	-0.23	4.36	+0.13	2.48	+0.52
2,500.....	2.31	-0.01	1.92	-0.53	1.25	-0.18	4.26	+0.82	2.12	+0.43
3,000.....	2.04	+0.05	0.87	-0.97	0.97	-0.14	3.88	+1.13	2.00	+0.51
3,500.....	1.74	+0.03	-----	-----	0.76	-0.04	-----	-----	1.68	+0.37
4,000.....	1.32	-0.15	-----	-----	0.63	+0.05	-----	-----	1.60	+0.45
4,500.....	-----	-----	-----	-----	-----	-----	-----	-----	1.47	+0.46

¹ Naval Air Station data omitted owing to insufficient number of airplane observations during January to determine reliable monthly mean.

TABLE 2.—Free-air resultant winds (m. p. s.) during January, 1927

Altitude (m.) m. s. l.	Broken Arrow, Okla. (233 meters)				Due West, S. C. (217 meters)				Ellendale, N. Dak. (444 meters)				Groesbeck, Tex. (141 meters)				Royal Center, Ind. (225 meters)				Washington, D. C. (34 meters)			
	Mean		9-yr. mean		Mean		6-yr. mean		Mean		10-yr. mean		Mean		9-yr. mean		Mean		9-yr. mean		Mean		7-yr. mean	
	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.	Dir.	Vel.
Surface.....	S. 76°W.	0.8	S. 49°W.	1.1	N. 36°W.	1.2	N. 74°W.	1.1	S. 87°W.	3.7	N. 63°W.	2.9	S. 18°W.	3.4	N. 68°W.	0.5	S. 41°W.	1.3	S. 51°W.	1.9	N. 47°W.	2.1	N. 36°W.	1.7
250.....	S. 73°W.	0.9	S. 41°W.	1.2	N. 51°W.	1.1	N. 77°W.	1.3	S. 88°W.	4.7	N. 68°W.	3.5	S. 59°W.	1.8	N. 78°W.	0.6	S. 44°W.	1.7	S. 50°W.	2.3	N. 63°W.	3.6	N. 65°W.	3.3
500.....	S. 55°W.	2.2	S. 36°W.	2.4	N. 71°W.	2.4	W.	2.6	S. 88°W.	4.7	N. 68°W.	3.5	S. 52°W.	4.1	N. 59°W.	1.8	S. 51°W.	4.1	N. 60°W.	5.0	N. 63°W.	6.0	N. 71°W.	5.5
750.....	S. 63°W.	2.2	S. 41°W.	3.0	N. 73°W.	3.2	S. 84°W.	4.0	N. 79°W.	7.1	N. 67°W.	5.5	S. 56°W.	5.3	S. 61°W.	2.9	S. 65°W.	5.7	S. 66°W.	6.6	N. 62°W.	6.6	N. 71°W.	7.2
1,000.....	S. 72°W.	3.4	S. 58°W.	3.6	S. 80°W.	5.1	S. 81°W.	5.5	N. 73°W.	7.3	N. 63°W.	6.7	S. 60°W.	6.4	S. 64°W.	3.7	S. 76°W.	7.4	S. 75°W.	7.6	N. 57°W.	7.2	N. 69°W.	8.3
1,250.....	S. 75°W.	4.4	S. 71°W.	4.2	S. 76°W.	7.2	S. 87°W.	7.6	N. 69°W.	8.4	N. 63°W.	7.8	S. 62°W.	6.5	S. 70°W.	4.8	S. 86°W.	7.9	S. 80°W.	8.7	-----	-----	-----	-----
1,500.....	N. 86°W.	5.4	S. 73°W.	5.4	S. 85°W.	8.2	S. 86°W.	9.9	N. 68°W.	9.4	N. 64°W.	8.2	S. 63°W.	6.3	S. 74°W.	5.8	N. 85°W.	9.7	S. 84°W.	9.9	N. 71°W.	7.8	N. 68°W.	10.1
2,000.....	N. 86°W.	7.1	S. 82°W.	7.3	S. 85°W.	10.3	S. 87°W.	12.5	N. 64°W.	11.1	N. 65°W.	10.8	S. 59°W.	6.1	S. 79°W.	7.2	N. 85°W.	11.0	S. 85°W.	11.6	N. 65°W.	8.9	N. 72°W.	11.5
2,500.....	N. 87°W.	9.0	S. 87°W.	8.8	W.	11.8	S. 89°W.	15.2	N. 63°W.	13.6	N. 66°W.	12.9	N. 59°W.	7.4	S. 81°W.	8.6	N. 86°W.	11.6	W.	13.2	N. 56°W.	9.6	N. 80°W.	13.9
3,000.....	S. 85°W.	11.6	N. 89°W.	10.2	S. 87°W.	14.8	S. 87°W.	16.6	N. 56°W.	15.5	N. 67°W.	14.4	N. 52°W.	9.1	S. 82°W.	10.1	N. 88°W.	15.3	S. 89°W.	13.9	-----	-----	-----	-----
3,500.....	S. 88°W.	13.4	N. 86°W.	10.9	S. 77°W.	13.5	S. 84°W.	16.3	N. 76°W.	16.2	N. 68°W.	15.5	N. 33°W.	12.8	S. 84°W.	11.3	S. 87°W.	15.8	S. 83°W.	13.5	-----	-----	-----	-----
4,000.....	S. 85°W.	11.0	N. 86°W.	11.3	S. 67°W.	18.0	S. 81°W.	16.2	N. 76°W.	19.2	N. 63°W.	17.0	-----	-----	-----	-----	S. 75°W.	19.1	S. 74°W.	17.4	-----	-----	-----	-----
4,500.....	-----	-----	-----	-----	-----	-----	-----	-----	N. 45°W.	29.0	N. 56°W.	19.4	-----	-----	-----	-----	S. 76°W.	20.6	S. 76°W.	20.6	-----	-----	-----	-----

WEATHER IN THE UNITED STATES

GENERAL CONDITIONS

The month was characterized by greater than the normal atmospheric pressure, the rapid movement of cyclonic systems eastward along the northern border, the rather sluggish movement elsewhere; moderate temperature for midwinter; generally deficient rainfall, except in the upper Ohio Valley and thence southwestward to Oklahoma, where it was normal or above. The snowfall was light to moderate in the middle Atlantic area, the immediate Ohio Valley, the middle Missouri Valley, and in the southwest.

CYCLONES AND ANTICYCLONES

By W. P. DAY

The month was marked by a succession of high-pressure areas of considerable magnitude and mostly of polar origin. Three of these had maximum pressures around 31 inches. On the morning of the 9th high pressure extended from Alaska to southern Mexico, with a crest of 30.92 inches at Miles City, Mont. Again, on the 14th a great HIGH extended from Canada to Central America, with a maximum pressure of 31.10 inches at Rapid City, S. Dak. Later, between the 25th and 28th, a large HIGH moved slowly southeast from the Canadian Northwest to the middle Atlantic States, with several pressure readings as high as 31.06 inches as it passed over the Lake region.

On account of the prevailing high pressure during much of the month, the number of low-pressure areas plotted was reduced to 16 as compared with 23 for December. There were no unusually severe storms.

THE WEATHER ELEMENTS

By P. C. DAY

PRESSURE AND WINDS

The outstanding features of the weather for the first month of 1927 were the unusually high sea-level barometric pressures, 31 inches or above, observed over the north-central districts on the 8th and over central and northeastern districts on the 26th and 27th, the pressure on the latter dates being the highest of record at many stations on the Great Lakes, in portions of the Ohio Valley, and to the eastward; the widespread excess of temperature; and the greatly deficient precipitation over most southern and eastern districts.

The first decade was mainly free from important cyclonic storms, though about the 6th a low-pressure area developed in the middle Plateau and moved northeastward, reaching North Dakota by the 8th, whence it moved southeastward to the Carolina coast by the morning of the 10th, where it again curved to the northeast and passed off the New England coast, reaching Newfoundland by the morning of the 12th. At no point in its long course did this storm reach extensive proportions or give any wide distribution of important precipitation.

At the beginning of the second decade a storm developed in the far Southwest and by the morning of the 13th it was central over Missouri attended by local heavy rains near the center and by snow to the westward and northward. During the following 24 hours the storm moved rapidly to the lower St. Lawrence Valley and widespread rain or snow, mostly light, occurred over nearly all districts from the Mississippi Valley eastward to near the Atlantic coast. Immediately following the passage of this storm, another developed off the coast of southern New England attended by precipitation, mostly sleet or snow, along the entire Atlantic coast from the Carolinas to Maine, some heavy falls of snow occurring in southeastern New York and near-by areas.

Cyclonic disturbances were rather frequent in the central valleys and Southwest during the latter part of the second decade and the first half of the third, during which time important precipitation, mostly rain, occurred over the middle and lower Mississippi Valley and portions of the Ohio Valley as well as lighter falls of both rain and snow in near-by areas; none of these low areas developed important proportions, however, and few persisted as well-defined storms over long courses.

The last half of the third decade had little cyclonic activity, though considerable precipitation occurred from central California northward on the 27th to 29th, and there were widespread, but light rains over the eastern third of the country during the last three days.

Anticyclones rather dominated the weather of the month and persisted to an unusual extent over the Plateau region during the first decade, extending into the districts to the eastward by the end. Early in the second decade an anticyclone of unusual strength moved into the upper Missouri Valley and advanced eastward into the Atlantic coast districts by the 17th, being quickly followed by another over the more northern districts, and rather high pressure persisted for several days over the north-central districts, advancing later to New England, attended by severe cold over the Great Plains